HEPATITIS B AND HEPATITIS C INFECTION IN WEST VIRGINA

2016 Surveillance Summary

April 2018

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BUREAU FOR PUBLIC HEALTH

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Background

West Virginia (WV) is the only state entirely within the Appalachian Region of the United States (US). The state is largely rural with more than 44% of the population living in rural areas. The US Census Bureau estimated WV's 2016 population at 1,831,102, with nearly 18% under the poverty level. The population is predominantly white non-Hispanic (93.6%), with males (49.5%) and females (50.5%) almost equally distributed. Persons between the ages of 18 and 64 years old account for 60.3% of the population.

In August 2017, the WV Department of Health and Human Resources (DHHR) published the *West Virginia Drug Overdose Deaths Historical Overview, 2001-2015.* The report concluded that the drug overdose mortality rate in the state of 35.5 per 100,000 persons was more than twice the US mortality rate of 14.7 per 100,000 population. Overdose deaths were highest in the southern counties of the state. WV also had the highest age-adjusted drug overdose mortality rate in the nation. From 2012 to 2015, 2,504 drug overdose deaths were reported, and persons aged 35-54 years old accounted for 55.5% of these deaths.

Any physician diagnosis or positive laboratory report of hepatitis B virus (HBV) or hepatitis C virus (HCV) infection are reportable by law in WV, per WV Code 64 CSR-7. For many years, WV has had the highest rates of HBV and HCV infections in the country. The Centers for Disease Control and Prevention (CDC) Nationally Notifiable Disease Surveillance System (NNDSS) reported that between 2010 and 2015, WV had the highest annual incidence of acute HBV and 2nd highest annual incidence of acute HCV. A majority of HBV and HCV cases reported injection drug use and/or use of street drugs. A study conducted by Van Handel and colleagues identified 220 counties in the US most vulnerable to an outbreak of HIV or HCV infection, taking into consideration the sale of opioids, overdose deaths, and unemployment rates. Fifty percent of these counties are in Kentucky, Tennessee, and WV. Of the 55 counties in WV, 28 (51%) were considered most vulnerable and half of these were in the southern part of the state.

In the last 3 years, WV made significant changes to HBV and HCV surveillance to improve disease detection. In 2014, management of the hepatitis B program was transferred to DHHR's Division of Infectious Disease Epidemiology (DIDE). Reports of hepatitis B were followed up closely and managed carefully until the investigation was completed. The following year, the WV Electronic Disease Surveillance System (WVEDSS) started receiving electronic laboratory reports (ELRs). It was estimated that ELR increased the number of laboratory reports received by at least 60%. This estimate continues to increase every year as more reference and hospital laboratories are onboarded to send electronic laboratory reports. In 2016, the HBV and HCV surveillance evaluation reported more than 146,000 hepatitis-related laboratory results received and managed by DIDE staff. In the same year, DIDE adapted the 2016 HCV case definitions. This allowed DIDE to capture HCV cases that were previously excluded.

This report describes the HBV and HCV cases reported in WV for Morbidity and Mortality Weekly Report Year (MMWR) 2016.

Methods

The WV Communicable Disease Rule (64 CSR-7) requires the reporting of HBV and HCV infections within 1 day and 1 week of notification, respectively. Health care providers are required to report HBV and HCV infected patients while laboratories are required to report HBV and HCV-related test results. Disease reports are passively collected by local health department (LHD) and state health department staff and manually entered into WVEDSS, the state's web-based disease surveillance system. In 2015, WV began accepting electronic laboratory reports (ELR) from commercial laboratories and continues to onboard commercial and hospital laboratories to date. HBV and HCV reports entered in WVEDSS are investigated and managed by state and local health officials. Reports of HBV and HCV infections were ascertained using the latest surveillance case definitions established by the Council of State and Territorial Epidemiologists (CSTE) and the CDC. The 2012 case definitions for HBV were utilized to ascertain cases. HBV cases were classified as follows:

Acute Hepatitis B, confirmed case: A case that meets the clinical case definition, is laboratory confirmed, and is not known to have chronic HBV.

- *Clinical criteria:* An acute illness with a discrete onset of any sign or symptom* consistent with acute viral hepatitis (e.g., fever, headache, malaise, anorexia, nausea, vomiting, diarrhea, and abdominal pain), and either a) jaundice, or b) elevated serum alanine aminotransferase (ALT) levels >100 IU/L.
  *A documented negative hepatitis B surface antigen (HBsAg) laboratory test result within 6 months prior to a positive test (either HBsAg, hepatitis B "e" antigen (HBeAg), or hepatitis B virus nucleic acid testing (HBV NAT) including genotype) result does not require an acute clinical presentation to meet the surveillance case definition.
- *Laboratory criteria:* HBsAg positive, **AND** Immunoglobulin M (IgM) antibody to hepatitis B core antigen (IgM anti-HBc) positive (if done).

Chronic Hepatitis B, confirmed case: A person who meets either of the laboratory criteria below for diagnosis.

Chronic Hepatitis B, probable case: A person with a single HBsAg positive or HBV DNA positive (including qualitative, quantitative and genotype testing) or HBeAg positive lab result and does not meet the case definition for acute HBV.

- *Clinical criteria:* No symptoms are required. Persons with chronic HBV infection may have no evidence of liver disease or may have a spectrum of disease ranging from chronic hepatitis, cirrhosis or liver cancer.
- *Laboratory criteria:* Immunoglobulin M (IgM) antibodies to hepatitis B core antigen (IgM anti-HBc) negative **AND** a positive result on one of the following tests: hepatitis B surface antigen (HBsAg), hepatitis B e antigen (HBeAg), or nucleic acid test for hepatitis B virus DNA (including qualitative, quantitative and genotype testing), **OR** HBsAg positive or nucleic acid test for HBV DNA positive (including qualitative, quantitative and genotype testing) or HBeAg positive two times at least 6 months apart (any combination of these tests performed 6 months apart is acceptable).

Perinatal Hepatitis B in the newborn: HBsAg positivity in any infant aged greater than 1-24 months who was born in the US or in US territories to an HBsAg-positive mother.

- *Clinical description*: May range from asymptomatic to fulminant hepatitis.

- *Laboratory criteria*: Hepatitis B surface antigen (HBsAg) positive.

Infants born to HBsAg-positive mothers should receive hepatitis B immune globulin (HBIG) and the first dose of hepatitis B vaccine within 12 hours of birth, followed by the second and third doses of vaccine at 1 and 6 months of age, respectively. Post-vaccination testing for HBsAg and anti-HBs (antibody to HBsAg) is recommended from 3 to 6 months following completion of the vaccine series. If HBIG and the initial dose of vaccine are delayed for >1 month after birth, testing for HBsAg may determine if the infant is already infected.

The 2016 HCV case definitions were used to ascertain HCV cases. Acute and chronic HCV 2016 case definitions classified cases as confirmed and probable. The 2016 HCV case definitions are as follows:

Acute Hepatitis C, confirmed case: A case that meets clinical criteria below and has a positive hepatitis C virus detection test (HCV NAT or HCV antigen), **OR** a documented negative HCV antibody, HCV antigen or NAT laboratory test result followed within 12 months by a positive result of any of these tests (test conversion).

Acute Hepatitis C, probable case: A case that meets clinical criteria below and has a positive anti-HCV antibody test but has no reports of a positive HCV NAT or positive HCV antigen tests AND does not have test conversion within 12 months or has no report of test conversion.

- *Clinical criteria:* An illness with discrete onset of any sign or symptom consistent with acute viral hepatitis (e.g., fever, headache, malaise, anorexia, nausea, vomiting, diarrhea, and abdominal pain), **AND** (a) jaundice, **OR** (b) a peak elevated serum alanine aminotransferase (ALT) level >200 IU/L during the period of acute illness.
- *Laboratory criteria:* A positive test for antibodies to hepatitis C virus (anti-HCV), or hepatitis C virus detection test: Nucleic acid test (NAT) for HCV RNA positive (including qualitative, quantitative or genotype testing), a positive test indicating presence of hepatitis C viral antigen(s) (HCV antigen).

Chronic Hepatitis C, confirmed case: A case that does not meet clinical criteria or has no report of clinical criteria, **AND** does not have test conversion within 12 months or has no report of test conversion, **AND** has a positive HCV NAT or HCV antigen test.

Chronic Hepatitis C, probable case: A case that does not meet clinical criteria or has no report of clinical criteria AND does not have test conversion within 12 months or has no report of test conversion, **AND** has a positive anti-HCV antibody test, but no report of a positive HCV NAT or positive HCV antigen test.

- *Clinical criteria:* No available evidence of clinical and relevant laboratory information indicative of acute infection (refer to the criteria for classification Table VII-B in CSTE position statement 15-ID-03). Most hepatitis C virus (HCV)-infected persons are asymptomatic; however, many have chronic liver disease, which can range from mild to severe.
- *Laboratory criteria:* A positive test for antibodies to hepatitis C virus (anti-HCV), or hepatitis C virus detection test, such as: Nucleic acid test (NAT) for HCV RNA positive (including qualitative, quantitative or genotype testing), or a positive FDA-approved test indicating presence of hepatitis C viral antigen(s) (HCV antigen).
- *Criteria to distinguish a new case from an existing case:* A new chronic case is an incident chronic hepatitis C case that meets the case criteria for chronic hepatitis C and has not previously been

reported. A confirmed acute case may not be reported as a probable chronic case (i.e., HCV antibody positive, but with an unknown HCV RNA NAT or antigen status).

The process of disease investigation was guided by disease protocols developed by the DIDE found at www.dide.wv.gov.

In 2017, HBV and HCV surveillance data were downloaded from the WVEDSS. Disease investigation information was reviewed, summarized, and analyzed using Microsoft Excel®. The 2015 US Census data was used to estimate the rates of HBV and HCV infections per 100,000 persons in WV.

HBV and HCV co-infection was analyzed by summarizing and comparing all cases retrieved from WVEDSS and finding the exact match to the patient's first and last name and date of birth. Not all chronic HBV cases were captured in WVEDSS during the cross-match since a separate database was maintained during this time. The chronic HBV registry began transitioning to WVEDSS in early 2017.

Results

From 2007 to 2016, a total of 1,576 acute HBV and 456 acute HCV cases were reported. Table 1 shows the number and percentage of 2016 HBV and HCV cases detected relative to the number of investigations conducted.

In 2016, 568 reports of acute HBV infections were investigated resulting to the identification of 268 (47.2%) cases of acute HBV, while 223 investigations of acute HCV reports resulted to the detection of 132 (59.2%) acute HCV cases, 37.5% of which were probable HCV cases.

Table 1. Counts and percentages of 2016 HBV and HCV investigations that were cases, WV

Condition	Number of Investigations	Cases		% of Cases
		Number of Cases	% of Investigations	
Acute HBV	568	268	47.2	
Chronic HBV	355	353	99.4	
Acute HCV	223	132	59.2	
Confirmed		96		62.5
Probable		36		37.5
Chronic HCV	6,506	6,316	97.1	
Total	7,652	7,069	92.4	

Among the 621 HBV cases reported in 2016, 103 (16.6%) were found to be co-infected and reported with HCV between 2012 and 2016. In contrast, only 66 (1%) HCV cases reported in 2016 were found to be co-infected and reported with HBV from 2012 to 2016.

Figure 1 compares the trend and incidence of acute HBV and acute HCV infections in WV with the US average. Rates of acute HBV and acute HCV infections in WV continue to rise despite a stable trend in the US. Between 2010 and 2016, a 300% increase in the rate of acute HBV (from 4.7 to 14.5 per 100,000 persons), and a 700% increase in the rate of acute HCV (from 1.1 to 7.2 per 100,000 persons) was observed in WV. In 2016, the rate of acute HBV in WV was 14.5 times while acute HCV was 7 times

the national average; the highest in the country. Additionally, in 2016, the rate of acute HBV infections in the state was almost three times that of acute HCV infections.

Figure 1. Incidence[1] of acute HBV and acute HCV infections in WV compared with the U.S., 2007-2016 (n=1,709)

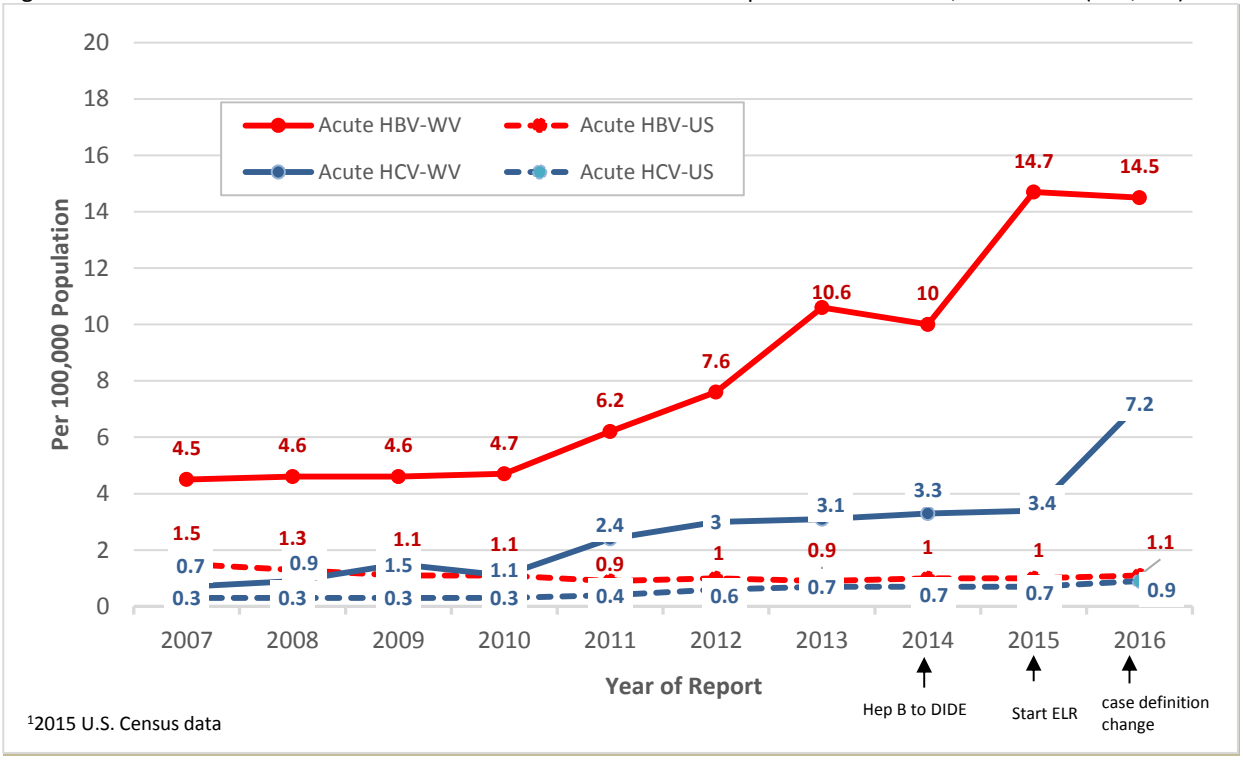
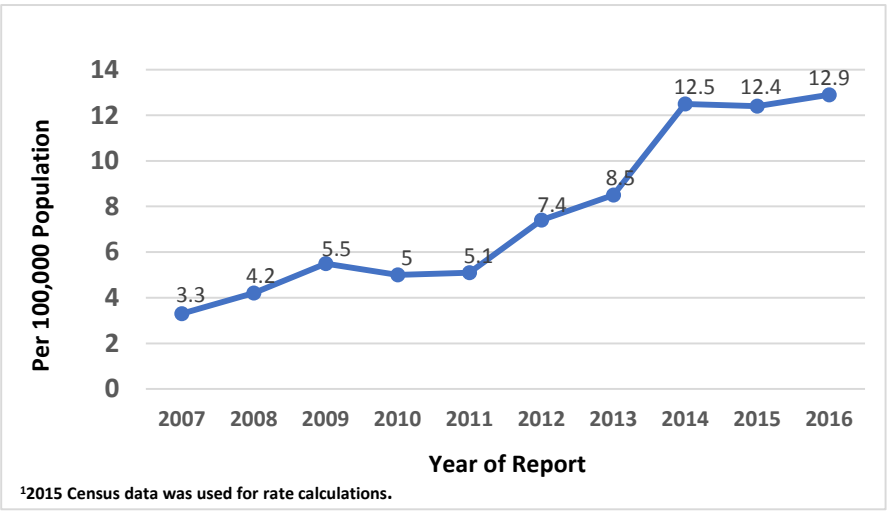


Figure 2. Rate[1] of chronic HBV Infection, WV, 2007-2016 (n=1,421)



In 2016, WV detected 12.9 newly reported cases of chronic HBV per 100,000 persons. The number of newly reported cases has increased steadily every year such that during the 10-year period (from 2007 to 2016), an increase of 291% was observed.

Geographical Distribution of HBV and HCV cases

Figure 3 shows the map of the US and compares WV's 2016 rates of acute HBV with neighboring states. WV had the highest rate of acute HBV per 100,000 persons.

In 2016, WV reported the 2nd highest incidence of acute HCV in the US (fig. 4). Other states experiencing high rates of HCV infection include Tennessee, and Rhode Island; both reported rates of acute HCV greater than 3 cases per 100,000 persons. (Source: CDC Division of Viral Hepatitis)

Figure 3. Rate of acute HBV infection per 100,000 population, U.S., 2016 (Source: CDC)

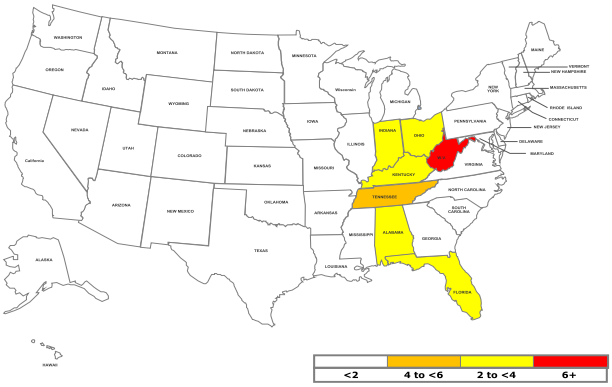


Figure 4. Rate of acute HCV infection per 100,000 population, U.S., 2016 (Source: CDC)

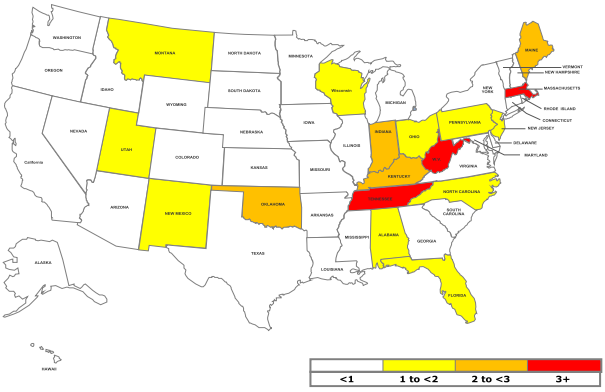


Table 2 lists the counts and rates of acute and chronic HBV and HCV infections for each county in WV. Counties in bold were considered as one of the most vulnerable to outbreaks of HIV or HCV infection. Clay county reported 4 cases of acute HBV. However, with a population of less than 9,000, the county had the highest rate of acute HBV and acute HCV infection at 45 and 22 per 100,000 persons, respectively. Kanawha county, the most populous county in the state had the highest number of newly reported cases of acute HBV and acute HCV.

Table 2. Acute and chronic HBV and HCV Infection, WV, 2016

County of Residence	Population (2015 U.S. Census)	Hepatitis B Infection			Hepatitis C Infection		
		Acute		Chronic	Acute		Chronic
		# Cases	Rate (per 100K pop.)	# Newly reported cases	# Cases	Rate (per 100K pop.)	# Newly reported cases
Barbour	16,704	1	6	0	0	0.0	66
Berkeley	111,901	3	2.7	17	5	4.5	247
Boone	23,372	8	34.2	3	0	0.0	110
Braxton	14,415	1	6.9	1	2	13.9	54
Brooke	23,350	3	12.8	1	0	0.0	46
Cabell	96,844	17	17.6	43	10	10.3	480
Calhoun	7,470	0	0	0	0	0.0	13
Clay	8,910	4	44.9	3	2	22.4	34
Doddridge	8,176	1	12.2	3	0	0.0	31
Fayette	44,997	6	13.3	10	0	0.0	208
Gilmer	8,518	0	0	4	0	0.0	32
Grant	11,766	0	0	0	0	0.0	17
Greenbrier	35,516	10	28.2	3	2	5.6	181

Hampshire	23,353	0	0	0	0	0.0	57

County of Residence	Population (2015 U.S. Census)	Hepatitis B Infection			Hepatitis C Infection		
		Acute		Chronic	Acute		Chronic
		# Cases	Rate (per 100K pop.)	# Newly reported cases	# Cases	Rate (per 100K pop.)	# Newly reported cases
Hancock	29,815	2	6.7	1	1	3.4	94
Hardy	13,852	0	0	2	2	14.4	39
Harrison	68,714	6	8.7	20	11	16.0	227
Jackson	29,237	1	3.4	3	1	3.4	73
Jefferson	56,482	2	3.5	9	0	0.0	86
Kanawha	188,332	55	29.2	55	28	14.9	808
Lewis	16,448	1	6.1	3	1	6.1	41
Lincoln	21,415	12	56	8	0	0.0	71
Logan	34,707	6	17.3	7	3	8.6	194
Marion	56,925	1	1.8	3	1	1.8	93
Marshall	31,978	3	9.4	1	1	3.1	77
Mason	27,037	7	25.9	10	0	0.0	176
McDowell	19,835	2	10.1	3	0	0.0	138
Mercer	61,164	8	13.1	17	11	18.0	325
Mineral	27,451	0	0	1	0	0.0	27
Mingo	25,292	8	31.6	9	2	7.9	139
Monongalia	104,236	1	1	11	1	1.0	164
Monroe	13,506	2	14.8	3	2	14.8	37
Morgan	17,524	0	0	0	0	0.0	44
Nicholas	25,594	4	15.6	4	0	0.0	107
Ohio	43,066	2	4.6	0	2	4.6	143
Pendleton	7,229	0	0	1	0	0.0	13
Pleasants	7,674	0	0	1	1	13.0	25
Pocahontas	8,607	0	0	1	0	0.0	44
Preston	33,940	1	2.9	10	0	0.0	140
Putnam	56,848	16	28.1	9	2	3.5	114
Raleigh	77,510	21	27.1	37	16	20.6	470
Randolph	29,126	0	0	4	0	0.0	63
Ritchie	9,982	0	0	0	0	0.0	33
Roane	14,435	3	20.8	0	1	6.9	32
Summers	13,239	2	15.1	0	2	15.1	53
Taylor	6,966	2	28.7	3	1	14.4	84
Tucker	6,966	0	0	0	0	0.0	4
Tyler	8,975	0	0	2	1	11.1	7
Upshur	24,758	0	0	1	0	0.0	34
Wayne	40,971	6	14.6	8	0	0.0	173
Webster	8,755	2	22.8	0	0	0.0	34
Wetzel	15,816	2	12.6	1	0	0.0	30
Wirt	5,880	2	34	0	0	0.0	7
Wood	86,452	33	38.2	11	18	20.8	153
Wyoming	22,151	1	4.5	6	2	9.0	124
WV	**1,844,128**	**268**	14.5	**353**	**132**	7.2	**6,316**

Figures 5 to 8 illustrate the geographical distribution of 2016 HBV and HCV cases in the state based on the patient's county of residence.

Figure 5.

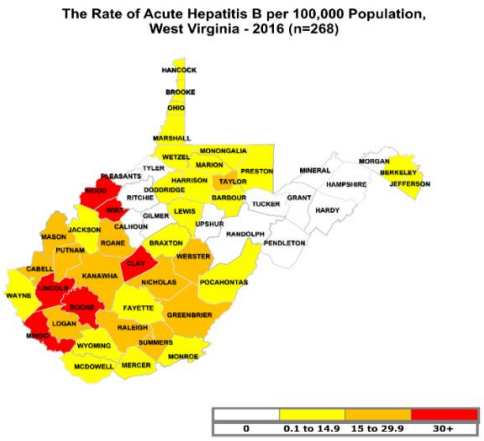


Figure 6.

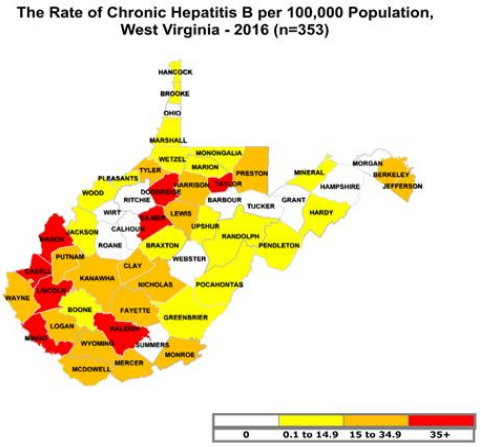


Figure 7.

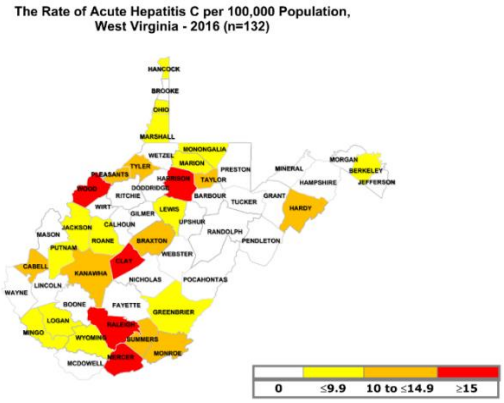
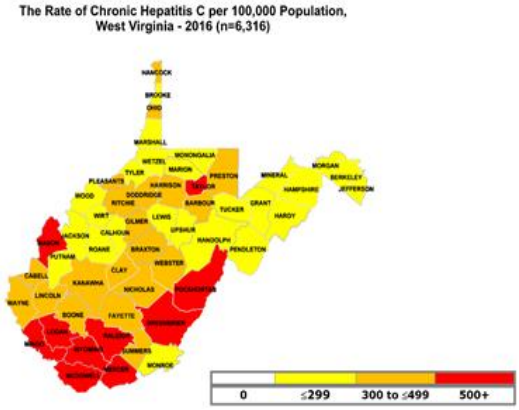


Figure 8.



Race Distribution of HBV and HCV cases

A majority of acute HBV (90%) and acute HCV (86%) cases in 2016 were white and non-hispanic (table 3). This was as expected since greater than 93% of WV's population is white and non-hispanic.

Table 3. Distribution of acute HBV and acute HCV cases by race, WV, 2016

	Acute HBV			Acute HCV		
Race	Count	Percentage	Rate*	Count	Percentage	Rate*
White non-hispanic	242	90%	13.1	113	85.6%	6.1
Black non-hispanic	2	1%	0.1	6	4.5%	0.3
Unknown	24	9%		13	9.8%	
Total	268	100%		132	100%	

*per 100,000 persons

Age Distribution of HBV and HCV cases

Table 4 shows the distribution of HBV and HCV case reports by age group. Persons between the ages of 30 and 39 years constitute more than a third of reports received, while those born between 1946-1964 (baby boomer cohort) account for slightly over 20% of HBV and chronic HCV reports.

Table 4. Percent distribution of acute HBV and acute HCV cases by age-group, WV, 2016

Age group (Years)	Acute HBV n=268	Chronic HBV n=353	Acute HCV n=132	Chronic HCV n=6316
	% of total	% of total	% of total	% of total
≤19	0.0	<1	3.8	1.8
20-29	13.8	9.9	34.8	25.7
30-39	31.3	34.0	33.3	31.5
40-49	30.6	28.4	21.2	16.6
50-59	17.2	16.7	6.1	15.3
≥60	7.1	10.8	0.8	8.9
Total	100.0	99.8	100.0	99.9
Born 1946-1964	21.6	20.4	6.1	22.6

Table 5 shows the age-adjusted rates of HBV and HCV infections. Similar to table 3, persons between 30 and 39 years old had the highest rates of HBV and chronic HCV, while persons 20-29 years old ranked first for acute HCV with 20.4 cases per 100,000 persons. Six chronic HCV cases were missing age information.

Table 5. Rate* of HBV and HCV infection adjusted by age-group, WV, 2016

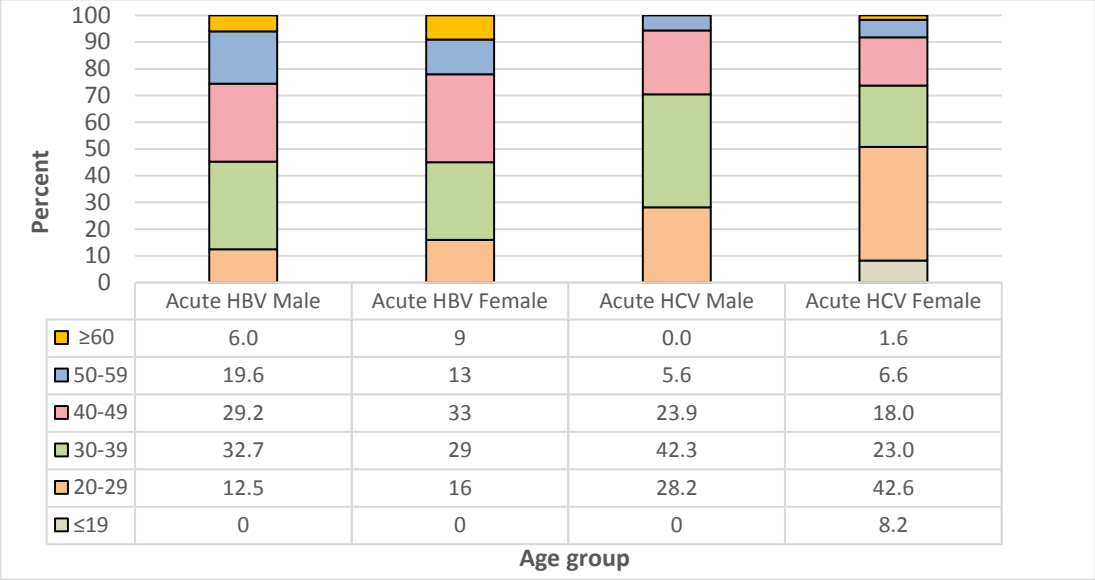
Age Group (years)	Acute HBV		Chronic HBV		Acute HCV		Chronic HCV	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate
≤19	0	0	1	0.8	5	4.2	111	92.4
20-29	37	16.4	35	15.5	46	20.4	1,626	720.6
30-39	84	36.6	120	52.3	44	19.2	1,991	867.9
40-49	82	32.4	100	39.5	28	11.1	1,051	415.0
50-59	46	16.3	59	20.9	8	2.8	966	341.8
≥60	19	4.5	38	9.0	1	0.2	565	133.6
Total	268		353		132		6,310	

*per 100,000 persons

Age and Gender Distribution of HBV and HCV cases

Figure 9 shows the distribution of acute HBV and acute HCV case reports by age-group and gender. Among acute HBV cases, males and females between the ages of 30 and 49 years old accounted for 62% of cases. Among acute HCV cases, males between 20-39 years old accounted for 70.5% of male cases, while females of the same age group comprised 65.6% of female cases. Patients aged 60 years old and over accounted for less than 10% of cases for each condition and gender.

Figure 9. Percent distribution of acute HBV and acute HCV cases by age group and gender, WV, 2016



	Acute HBV Male	Acute HBV Female	Acute HCV Male	Acute HCV Female
≥60	6.0	9	0.0	1.6
50-59	19.6	13	5.6	6.6
40-49	29.2	33	23.9	18.0
30-39	32.7	29	42.3	23.0
20-29	12.5	16	28.2	42.6
≤19	0	0	0	8.2

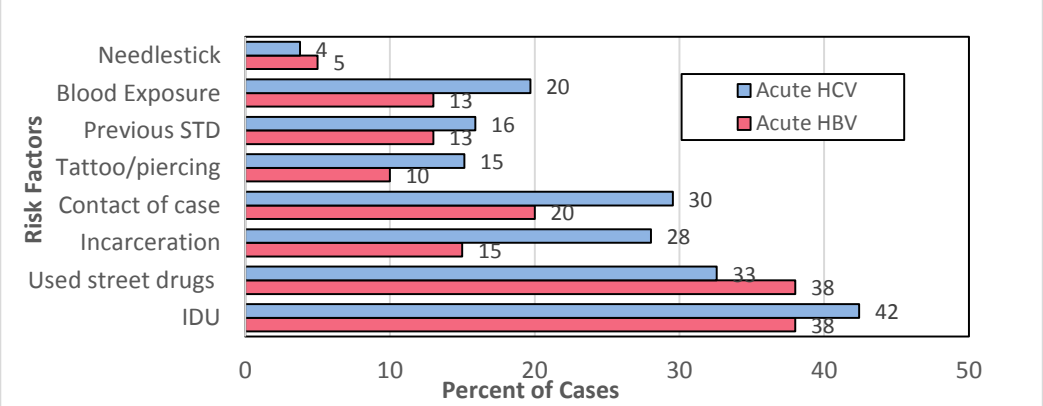
Age group

Risk Factor Distribution of HBV and HCV cases

Risk factors of acute HBV and acute HCV cases were identified and compared (fig. 10). Note that a case can report more than one risk factor. Drug use (intravenous and non-intravenous), the most commonly reported risk factor was reported by more than a third of acute HBV and acute HCV cases.

Additionally, an estimated 30% of acute HCV cases also reported being a contact of a case as well as history of incarceration. A contact of a case was defined as an individual who has had sexual contact or is/was a household contact, or shared drug paraphernalia with someone suspected or confirmed to be infected with HBV and/or HCV.

Figure 10. Percent of acute HBV and acute HCV cases with risk factors, WV, 2016



Risk factors of male and female patients with acute HBV and acute HCV infection were compared (fig. 11 and 12). On both conditions, a patient can report more than one risk factor. Among male patients with acute HBV and acute HCV infection, between 39% and 42% reported intravenous drug use (IDU) and/or use of street drugs, slightly higher than females. Incarceration was reported twice as much among males with acute HBV (fig. 11) and more than 6 times as much among those with acute HCV

infection (figure 12) than females. On the other hand, more females with acute HBV and acute HCV infection reported being a contact of a case, previous STD, blood exposure and needlestick.

Figure 11. Percentage of male and female acute HBV cases with risk factors, WV, 2016

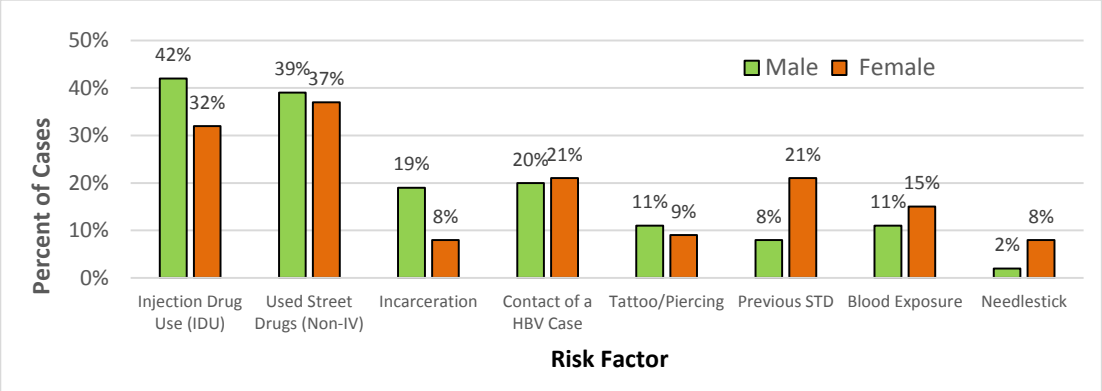
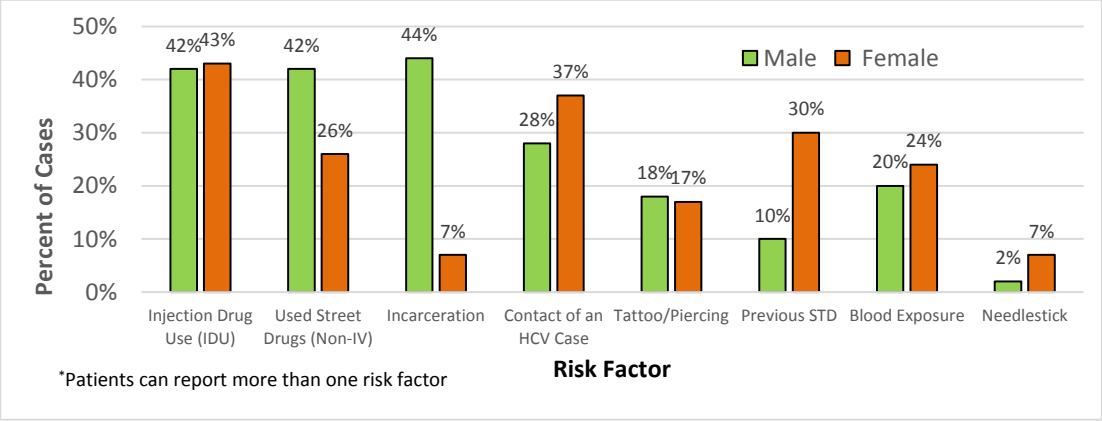
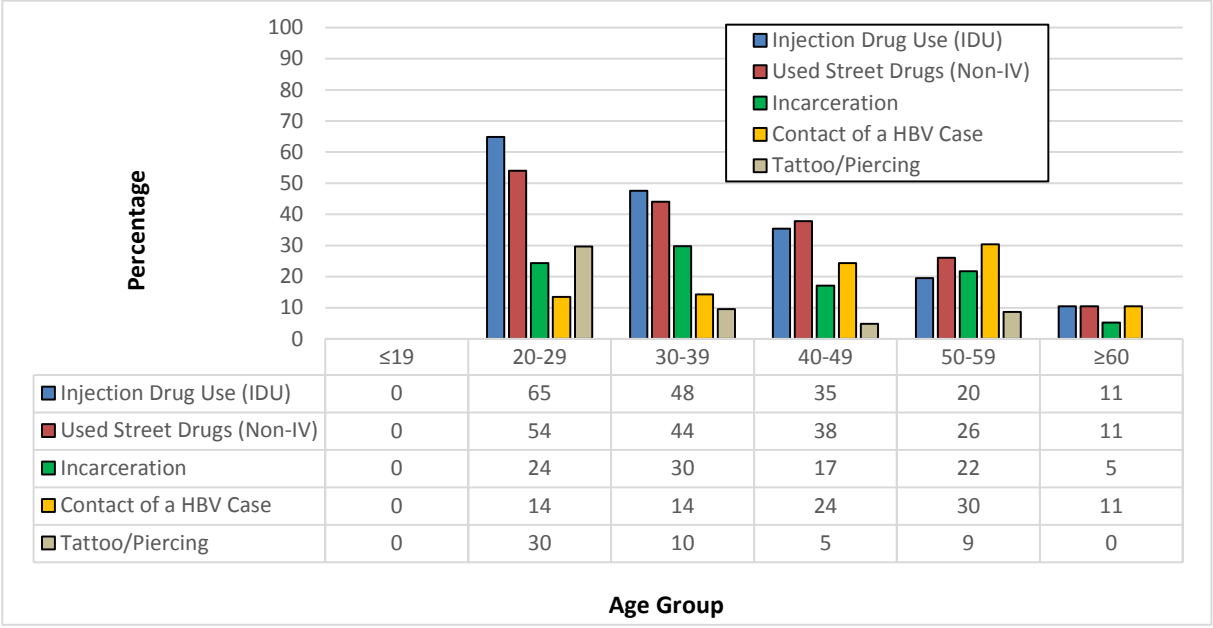


Figure 12. Percentage of male and female acute HCV cases with risk factors, WV, 2016



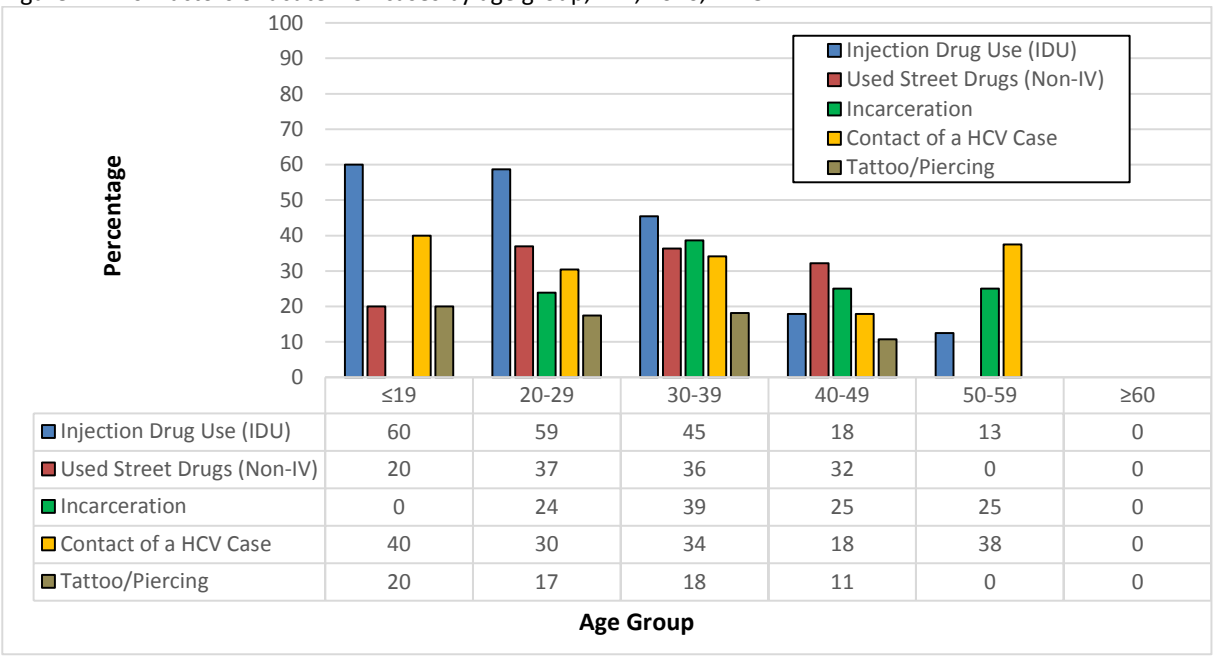
Figures 13 and 14 stratifies the risk factor of acute HBV and acute HCV cases for each age group. A case can report more than one risk factor. In 2016, no acute HBV infection was reported in the youngest age group. However, among acute HCV cases of a similar age group, 60% reported IDU. IDU was also the most commonly reported risk factor among acute HBV and acute HCV cases in the 20-29 and 30-39 age groups. In contrast, for both conditions, among the 40 to 49 age group, non-IV was the most frequently reported risk factor with more than 30% reporting, while cases between the ages 50 and 59 years old reported contact with a case as the most common risk factor. No acute HCV case over 59 years old reported any of the risk factors. Incarceration was the second most commonly (25%-39%) reported risk factor for acute HCV cases between the ages of 30 and 59 years.

Figure 13. Risk factors of acute HBV cases by age group, WV, 2016, n=268



	≤19	20-29	30-39	40-49	50-59	≥60
Injection Drug Use (IDU)	0	65	48	35	20	11
Used Street Drugs (Non-IV)	0	54	44	38	26	11
Incarceration	0	24	30	17	22	5
Contact of a HBV Case	0	14	14	24	30	11
Tattoo/Piercing	0	30	10	5	9	0

Figure 14. Risk factors of acute HCV cases by age group, WV, 2016, n=132



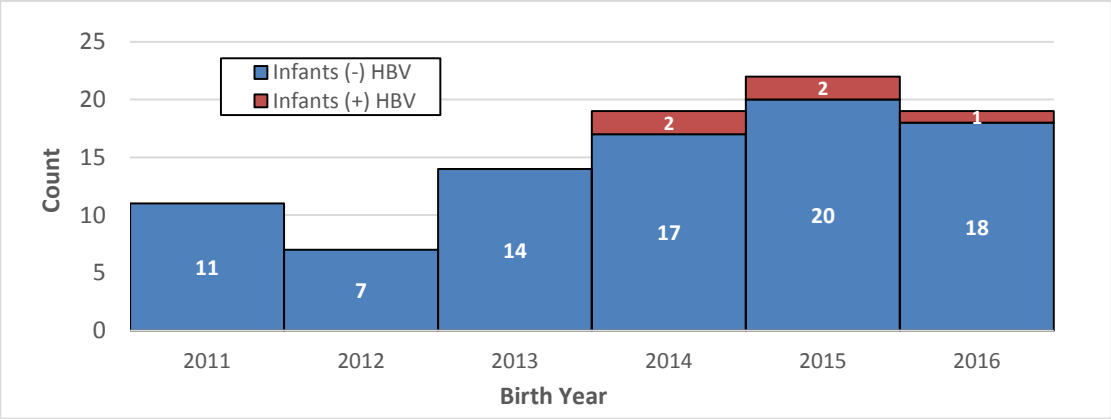
	≤19	20-29	30-39	40-49	50-59	≥60
Injection Drug Use (IDU)	60	59	45	18	13	0
Used Street Drugs (Non-IV)	20	37	36	32	0	0
Incarceration	0	24	39	25	25	0
Contact of a HCV Case	40	30	34	18	38	0
Tattoo/Piercing	20	17	18	11	0	0

Perinatal Hepatitis B

The perinatal hepatitis B (PHB) program was managed by the Division of Immunization Services. During the 6-year period, from 2011 to 2016, an average of 20,250 births occurred per year; maximum of 20,829 in 2013 and a minimum of 19,042 in 2016. Since 2014, the birth rate in WV has dropped an average of 3% per year from the prior year.

Between 2011 and 2016, a total of 92 infants (fig. 14) were identified as being born to HBV positive mothers, 65% of whom were identified in the latter 3 years. Infants were managed and followed-up jointly by the local and state public health officials until post-vaccination testing for HBsAg and anti-HBs was performed. Among the 92 infants identified, 5 (5.4%) were determined to be infected with HBV. The percentage of infants who completed the vaccine series by age 12 months was not available during the time this report was written.

Figure 14. PHB infection among infants in born between 2011 and 2016, WV, n=5



Conclusion

Through the collaborative effort among health care providers, laboratories, and public health, and recent changes in surveillance, WV was able to improve detection and better describe HBV and HCV infection in the state. Within the last decade, HBV and HCV infection rates have risen sharply in WV. From 2010 to 2016, there has been a 300% increase in the rate of acute HBV and a 700% increase in the rate of acute HCV infections. While the rate of acute HBV infections has plateaued (approximately 14 cases per 100,000 persons) from 2015 to 2016, the rate of acute HCV infection has more than doubled in 2016 (7.2/100,000) from 2015 (3.4/100,000).

The *West Virginia Drug Overdose Deaths Historical Overview, 2001-2015* reviewed the use of opiates and polypharmacy in the state and concluded that drug overdose mortality was more than double that of the U.S. Furthermore, from 2015 to 2016, WV's overdose mortality rate increased by 25.3% to 52 per 100,000, the highest in the country.

Increased drug use has certainly changed the landscape of HBV and HCV infection in WV. This report shows that HBV and HCV infection follows the trend of drug use in the state. Most hepatitis cases, regardless of gender reported intravenous and non-intravenous drug use as the most common risk factor in addition to other risk factors. Persons between the ages of 30 and 49 years accounted for 62% of acute HBV infections, while younger adults (20 to 39 years old) comprised 68% of acute HCV cases. Individuals born between 1946 and 1964 accounted for about 20% of HBV and chronic HCV cases. About 40% of males and females with acute HCV reported IDU, while a third of females with acute HBV reported IDU. Among age groups, 60% of hepatitis cases between ≤19 and 29 years and 45% of cases between 30 and 49 years old reported IDU. More than half of the counties, many in the southern part of the state, were considered highly vulnerable to HIV and HCV outbreaks. Twenty counties exceeded the state's average acute HBV infection rate, while 16 counties exceeded WV's

average acute HCV infection rate. Six (Boone, Logan, Mingo, Nicholas, Taylor and Wayne) counties had acute HBV and HCV infection rates that were higher than state's average. Poverty, unemployment and rampant drug use plagued many of these counties.

Hepatitis co-infection was also observed among cases. Nearly 17% of HBV cases were co-infected with HCV, while 1% of HCV cases were co-infected with HBV. Again, many of these cases report IDU as a risk factor.

Among pregnant women, a noticeable increase in the number of HBsAg positive mothers was observed in the last 3 years leading to 5 infants diagnosed with perinatal hepatitis B infection. This finding emphasizes the need to screen pregnant women for hepatitis B and communicate findings to public health and birthing facilities to provide the necessary and timely intervention to the newborn infant. In January 2018, the CDC released the *Prevention of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices,* which includes guidance on the care of infants born to HBsAg-positive women or women with unknown HBsAg status.

Mitigating the rise of hepatitis infections requires collaboration among social services, health care providers, public health, harm reduction providers, and treatment centers such as substance abuse facilities. Training and resources are needed for health care providers to report and link patients to hepatitis care. Highly vulnerable areas and groups need to be prioritized for intervention. While DHHR has embarked on initiatives (*e.g.* assist harm reduction programs and linkage to care) to support these needs, coordinated and sustained efforts (with partners) are essential to achieve continued success.

At least 6 limitations are identified in this report: (1) Asymptomatic HBV or HCV positive patients and uninsured patients may not seek medical care, and (2) HBV and HCV surveillance relies solely on passive reporting by health care providers, hospitals, laboratories, and local health departments. Hence, the numbers in this report may underestimate the true burden of disease. (3) Patient risk factor data are provided by patients and/or obtained from health care provider clinical record. Information not disclosed by the patient or health care provider are not captured in this report. (4) WV implemented ELR in 2015 which automated reporting of hepatitis test results to WVEDSS. This resulted to detection of more hepatitis cases. (5) Adaptation of the 2016 hepatitis C case definitions in the latter part of the year changed case ascertainment and allowed for the detection of more cases. (6) Some patients who were initially reported as 'suspect' cases were later lost to follow-up investigation. With insufficient information to ascertain these patients as cases, these patients were excluded.

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Acknowledgement

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